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OBSERVATIONS ON THE AMPHIPOD GENUS PARHYALE

By Clarence R. Shoemaker

The genus *Parhyale* was created by T. R. R. Stebbing in 1897 for an amphipod taken at St. Thomas, Virgin Islands, because it differed from *Hyale* by the possession of a minute inner ramus to the third uropod, a character which had not been noted in any member of the Talitridae. This inner ramus having been overlooked by all students of the Amphipoda, the species of *Parhyale* had been assigned to *Hyale* or *Allorchestes*. Stebbing described and figured the species *Parhyale fasciger* (later changing the name to *fascigera*) from St. Thomas, Virgin Islands. In 1853 James D. Dana described a species *Allorchestes hawaiensis* from Maui, Hawaiian Islands, and figured it in 1855. He did not, however, describe or figure the small inner ramus to the third uropod which this species possesses. Stebbing (1906, p. 573) transferred Dana's species to *Hyale*, but gave it doubtful specific status. Dr. A. Schellenberg (1938, p. 66) correctly identified specimens of this species from Hawaii, but continued to place the species in *Hyale*.

Parhyale kurilensis was described by Masao Iwasa (1934, p. 1) from specimens taken in the Kurile Islands. A. N. Derjavin (1937, p. 106) made Iwasa's species a synonym of Brandt's species *Allorchestes ochotensis*, which was made the genotype of a new genus *Parallorchestes* by Shoemaker (1941, p. 183). Derjavin at the same time transferred Brandt's species to *Parhyale*, making it *Parhyale*

ochotensis. *Parhyale zibellina* described by Derjavin (1937, p. 109) from the Soviet coast of the Sea of Japan appears to belong to the genus *Parallorchestes*.

The genus *Hyaloides* created by Schellenberg (1939, p. 126) for specimens from Banana, Belgian Congo, differs from *Parhyale* only by the lobe of the fifth joint of the second gnathopod of the male. As this lobe is present only in the males of *Parhyale fascigera* and *P. hawaiensis* which are not fully mature, and is entirely lost in the fully mature males, *Hyaloides* becomes a synonym of *Parhyale*. This lobe is present also in the not fully mature males of many species of *Hyale*, but is lost by full maturity.

The following combination of characters separates *Parhyale* from *Hyale:* Antenna 1 reaching well beyond the peduncle of antenna 2; antenna 2 rather long with many-jointed flagellum; maxilliped with a dense brush of spines or setae at the apex of the third joint of the palp. Uropod 3 with small inner ramus; telson cleft to base; seventh joint of all peraeopods short, curved only at the nail, and bearing a stout seta on inner margin. The female is like the male except in the gnathopods, which are slender and weaker.

Up to the present time two species of *Parhyale* have been described, *P. fascigera* Stebbing and *P. hawaiensis* (Dana). They are widely distributed in the warmer waters of the bays and estuaries of the globe, and have been described at times as species of *Hyale*.

Parhyale fascigera Stebbing

FIGURES 1, 2,*a–f*

Parhyale fasciger Stebbing 1897, p. 26, pl. 6.
Parhyale fascigera Stebbing 1906, p. 556.
Hyale brevipes Shoemaker 1933, p. 18, figs. 10, 11.
Hyale hawaiensis Shoemaker 1942, p. 18.

Stebbing's description and figures are good, though they appear to be of somewhat smaller specimens than have been used for the present description and figures.

MALE: Head nearly as long as the first two body segments combined. Eye more or less pyriform, and dark brown in alcohol. Antenna 1: Reaching well beyond the peduncle of antenna 2; flagellum much longer than peduncle and composed of from 11 to 15 joints. Antenna 2: Nearly half as long as the body; fourth and fifth peduncular joints nearly equal in length; flagellum about twice as long as the peduncle and composed of from 15 to 24 joints.

Mandible with well-developed molar and toothed cutting edge; spine-row of five or six spines and several plumose setae. Maxilla 1: With rather slender inner plate bearing two apical plumose setae;

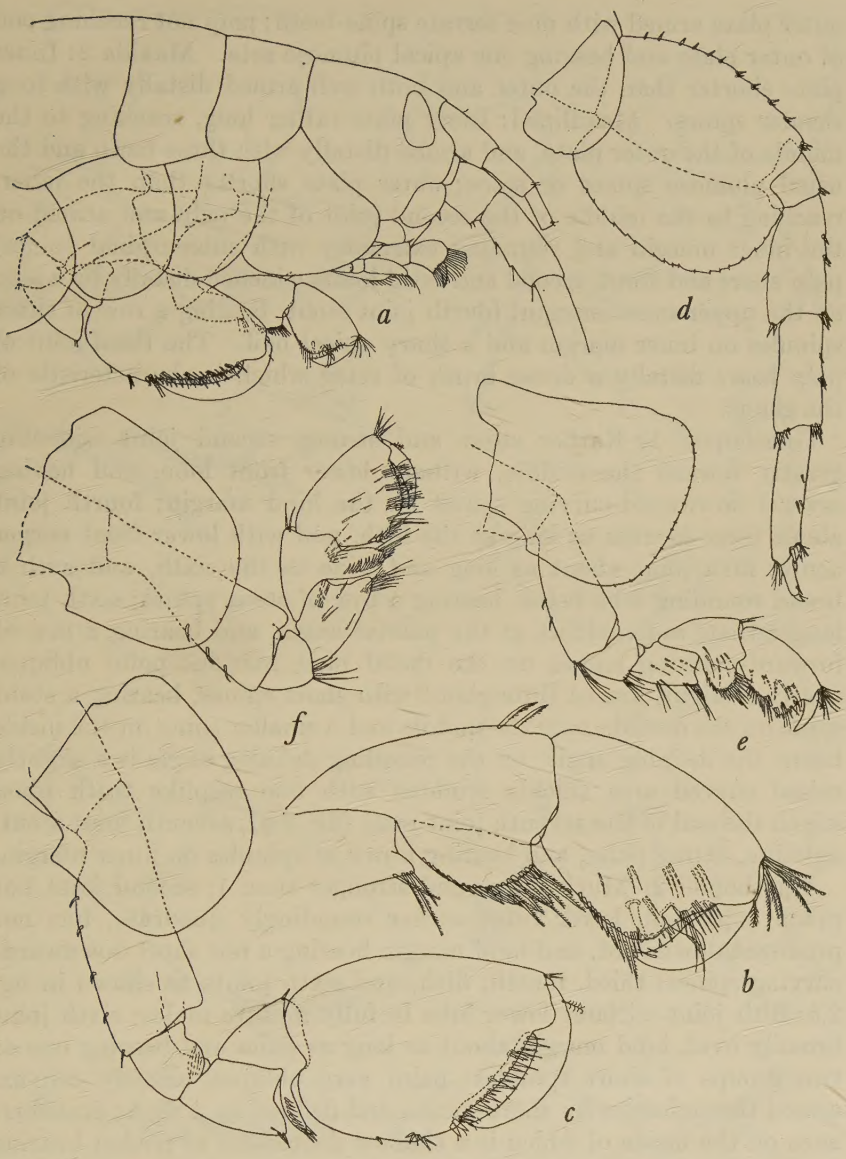

Figure 1.—*Parhyale fascigera* Stebbing. *a-f*. Male from Martinique, West Indies: *a*, front end of animal; *b*, end of gnathopod 1, much enlarged; *c*, gnathopod 2, immature; *d*, peraeopod 5. *e,f*, Female from Martinique, West Indies: *e*, gnathopod 1; *f*, gnathopod 2.

outer plate armed with nine serrate spine-teeth; palp not reaching end of outer plate and bearing one apical plumose seta. Maxilla 2: Inner plate shorter than the outer and both well armed distally with long slender spines. Maxilliped: Inner plate rather long, reaching to the middle of the outer plate, and armed distally with three teeth and the usual plumose spines or setae; outer plate shorter than the inner, reaching to the middle of the second joint of the palp and armed on the inner margin and rounding extremity with submarginal spines; palp short and stout, second and third joints widened distally by a lobe on the upper inner margin; fourth joint stout, bearing a row of short spinules on inner margin and a sharp apical nail. The third joint of palp bears distally a dense brush of setae which is characteristic of the genus.

Gnathopod 1: Rather stout and strong, second joint widening greatly toward the middle, without lower front lobe, and having several downward-curving spines on the hind margin; fourth joint about three-fourths as long as the fifth, and with lower front corner acute; fifth joint about as long and wide as the sixth, and with a broad rounding lobe below bearing a row of stout spines; sixth joint longer than wide, widest at the palmar angle, and bearing a row of forward-pointing spines on the distal hind margin; palm oblique, nearly straight, armed throughout with short spines, bearing a stout spine on the outside near the middle and a smaller spine on the inside below the defining angle; on the rounding defining angle is a slightly raised curved area thickly studded with fine rasplike teeth upon which the end of the seventh joint rests (fig. 2,*a*); seventh joint stout, aquiline, fitting palm, and bearing a row of spinules on inner margin.

Gnathopod 2: Much larger and stronger than 1, second joint not much expanded, lower front corner roundingly quadrate, but not produced downward, and hind margin bearing a few short downward-curving spines; third, fourth, fifth, and sixth joints as shown in fig. 2,*b*; fifth joint without lower lobe in fully mature males; sixth joint broadly oval, hind margin about as long as palm and bearing one or two groups of short spinules; palm very oblique, slightly convex, armed throughout with short spines, and defined by a slight protuberance on the inside of which is a shallow depression or pocket bearing two or three short spines; seventh joint rather strong, fitting palm with the apex resting in the shallow pocket on the inside of the defining angle (fig. 2,*b*). In the younger or not fully mature males the fifth joint of gnathopod 2 is produced into a narrow curving lobe between the fourth and sixth joints (fig. 1,*c*).

Peraeopods 1 and 2 are alike in structure, but 2 a little the shorter (fig. 2,*c*). Peraeopod 3 about equal in length to peraeopod 1. Peraeopods 3 to 5 much alike in structure, but 4 may be a little longer than

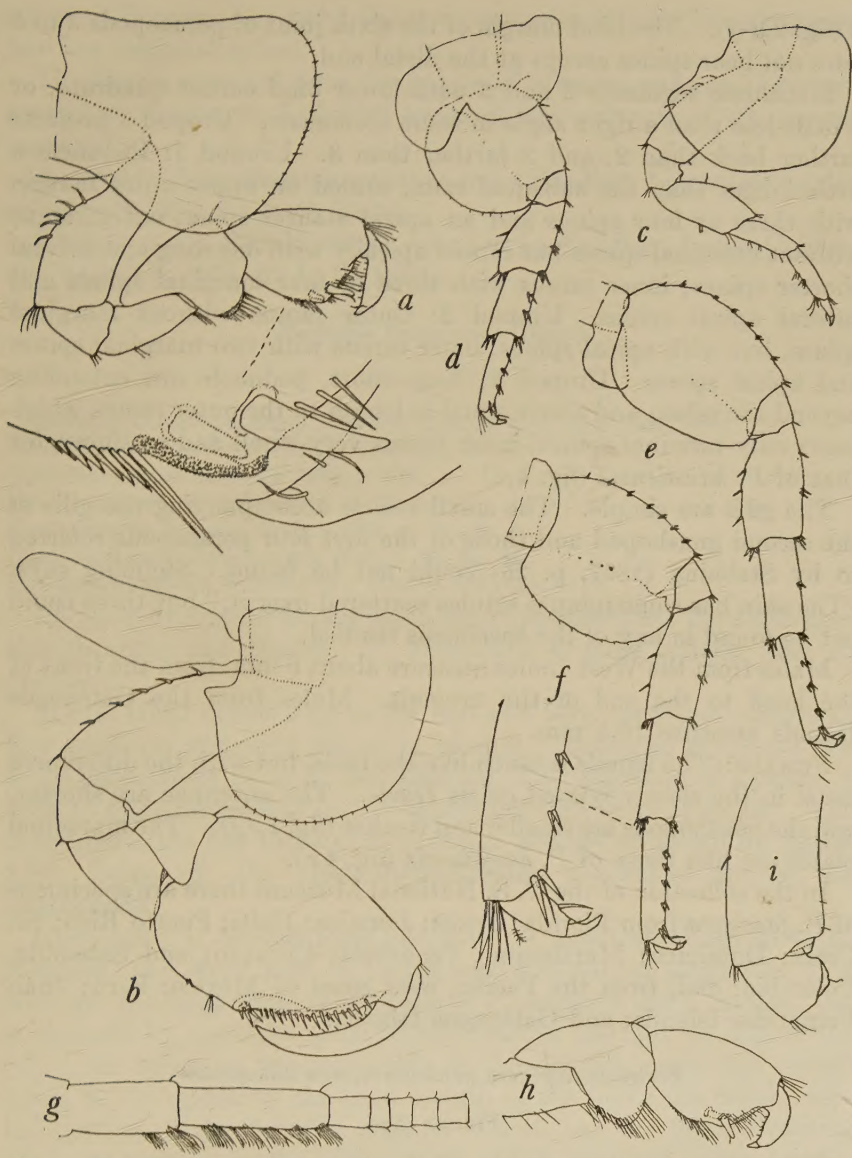

Figure 2.—*a-f*, *Parhyale fascigera* Stebbing, male from St. Croix, Virgin Islands: *a*, Gnathopod 1; *b*, gnathopod 2; *c*, peraeopod 2; *d*, peraeopod 3; *e*, peraeopod 4; *f*, peraeopod 5. *g-i*, *Parhyale fascigera penicillata*, new subspecies, male: *g*, antenna 2; *h*, gnathopod 1; *i*, second and third joints of gnathopod 2.

5 (fig. 2,*d–f*). The hind margin of the sixth joint of peraeopods 3 to 5 does not bear spines except at the distal end.

Metasome segments 2 and 3 with lower hind corner quadrate, or a little less than a right angle in some specimens. Uropod 1 projects farther back than 2, and 2 farther than 3. Uropod 1: Peduncle a little longer than the subequal rami, armed on upper outer margin with three or four spines and an apical stouter spine; outer ramus without marginal spines but armed apically with one long and several shorter spines; inner ramus with three or four marginal spines and several apical spines. Uropod 2: Outer ramus without marginal spines, but with apical spines; inner ramus with two marginal spines and apical spines. Uropod 3: Very short, peduncle not extending beyond the telson and about equal in length to the outer ramus which bears only terminal spines; inner ramus very small and as shown for that of *P. hawaiensis* (fig. 4,*n*).

The gills are simple. The small vesicle accompanying the gills of the second gnathopod and those of the first four peraeopods referred to by Stebbing (1897, p. 26) could not be found. Stebbing says, "The skin has some minute setules scattered over it," but these could not be found in any of the specimens studied.

Males from the West Indies measure about 9 mm. from the front of the head to the end of the uropods. Males from the Galápagos Islands measure 10.5 mm.

Female: The female is much like the male, but with the differences usual in the closely related genus *Hyale*. The antennae are shorter, and the gnathopods are smaller and weaker (fig. 1,*e,f*). The marsupial plates are like those of *P. hawaiensis* (fig. 4,*r*).

In the collection of the U. S. National Museum there are specimens of *P. fascigera* from Florida; Texas; Jamaica; Haiti; Puerto Rico; St. Croix; Dominica; Martinique; Venezuela; Curaçao; and Sabanilla, Colombia; and, from the Pacific, west coast of México; Perú; Juan Fernández Islands; and Galápagos Islands.

Parhyale fascigera penicillata, new subspecies

Figure 2,*g-i*

This subspecies is much like *P. fascigera*. Antenna 2 of the male carries two groups of plumose setae on the lower distal end of the fourth joint, and five groups on the lower margin of the fifth joint (fig. 2,*g*). The sixth joint of the first gnathopod of the male is narrower than in typical *fascigera*, and the large palmar spine is at the defining curve; the seventh joint is short. The second joint of the second gnathopod of the male is without a lobe at the lower front

corner. In uropods 1 and 2 the outer ramus is without lateral spines, but has terminal spines.

The female does not have the groups of plumose setae on the lower margin of the fourth and fifth joints of the peduncle of the second antenna.

A number of specimens were taken in La Paz Bay, Lower California, on May 2, 1921, by L. G. Rubio.

TYPE: A male, USNM 96983, taken in La Paz Bay, Lower California, March 2, 1921, by L. G. Rubio.

Parhyale hawaiensis (Dana)

FIGURES 3, 4

Allorchestes hawaiensis Dana 1853 and 1855, p. 900, pl. 61, figs. 5a-h.
Hyale brevipes Chevreux 1901, p. 400, figs. 15–18.
Hyale hawaiensis Stebbing 1906, p. 573.
Hyale trifoliadens Kunkel 1910, p. 72, fig. 27.
Hyale inyacka Barnard 1916, p. 233, pl. 28, fig. 4.
Hyale hawaiensis Schellenberg 1938, p. 66, fig. 34.
Hyaloides dartevellei Schellenberg 1939, p. 126, figs. 6–10.

Parhyale hawaiensis is very much like *P. fascigera*, but the differences though slight are definite. *P. hawaiensis* is more spinose than *P. fascigera*.

MALE: Head not as long as the first two body segments combined. Eye pyriform and light brown in alcohol. Antennae are about the same proportions as in *P. fascigera* (fig. 3,*a*); flagellum of antenna 1 with 15 to 17 joints, and that of antenna 2 with 24 to 29 joints. The mouthparts are like those of *P. fascigera* and are as shown by figures 3,*b-f*. Some of the most distinguishing characters are in the gnathopods.

Gnathopod 1: Second joint not quite so much expanded as in *P. fascigera;* the sixth joint is rather oval and not so suggestive of a triangle; the large spine of the palm of *P. fascigera* is not present, but is replaced by a smaller spine which is nearer the hind margin of the joint; the spine on the inner side of the defining angle has moved down to the middle of the hind margin of the joint; the raised rasping portion of the defining angle is absent, but the minute rasping teeth are present on the hind margin of the joint just below the defining spine (fig. 4,*b*); the seventh joint fitting palm and more or less quiline as in *P. fascigera*.

Gnathopod 2: Second joint not much expanded, but the lower front corner is produced into a narrow downward-pointing lobe which is very characteristic of this species, as it is present also in the second gnathopod of the female (figs. 3,*h* and 4,*r*); the front margin of the joint bears a few minute spinules and the hind margin bears several

short downward-curving spines; the following joints are like those of *P. fascigera*, and are as shown in figure 3,*h*.

Peraeopods 1 and 2 much alike but 2 is a little the shorter (figs. 3,*i* and 4,*d*). Peraeopod 3: About as long as peraeopod 2, second joint much expanded, being as wide as long; fourth joint not much expanded and little produced downward behind; fifth and sixth joints about equal in length; the front margin of all joints bearing groups of spines (fig. 3,*j*). Peraeopod 4: Considerably longer than 3, and a little shorter than 5; second joint not as much expanded as either that of 3 or 5, hind margin nearly straight, and with very shallow hind lobe; fourth joint not much expanded and not produced downward behind; fifth joint a little shorter than the sixth (figs. 3,*k* and 4,*g*). Peraeopod 5: Second joint much expanded, being as wide as long; fourth joint scarcely at all expanded; fifth joint a little shorter than the sixth. Both front and hind margin of sixth joint of peraeopods 4 and 5 with groups of spines (fig. 4,*g*,*j*). The seventh joint of all peraeopods is short and nearly straight except for the rather sharply upward-curving nail (fig. 4,*e*,*f*,*j*). This dactyl is very characteristic of *P. fascigera* and *P. hawaiensis*. All peraeopods are rather short, as was noticed by Chevreux when he described *Hyale brevipes* from the Sechelles Islands.

Metasome segments 2 and 3 with lower hind corner about quadrate or less than a right angle and not produced. Urosome segments 2 and 3 very narrow, not showing at all dorsally. Uropod 1 extending back farther than 2, and 2 farther than 3. Uropod 1: Peduncle longer than rami; upper outer margin bearing four to six spines besides the stout terminal spine, inner margin with about four spines; rami subequal in length, outer ramus with one to three marginal spines and a terminal group; inner ramus with spine arrangement same as that of outer ramus. Uropod 2: Peduncle equal to or a little longer than the rami, the outer of which is perhaps a little the shorter; peduncle with a few marginal spines; outer ramus with one or two marginal spines and a group of terminal spines; inner ramus with two or three marginal spines and terminal group. Uropod 3: Peduncle about equal in length to the outer ramus and reaching to about the end of the telson (figs. 4,*k*,*n*), inner ramus very small and bearing an apical spinule (fig. 4,*n*). Telson cleft to base with lobes widely gaping (fig. 3,*n*).

Coxal plate 1 is expanded below and produced forward as shown in figure 4,*a*. Coxal plates 2 to 4 are broadly and evenly rounding below. The gills of gnathopod 2 and those of peraeopods 1 to 4 are simple, as are those of *P. fascigera*. *P. hawaiensis* does not have minute setules scattered over the body integument which are said by

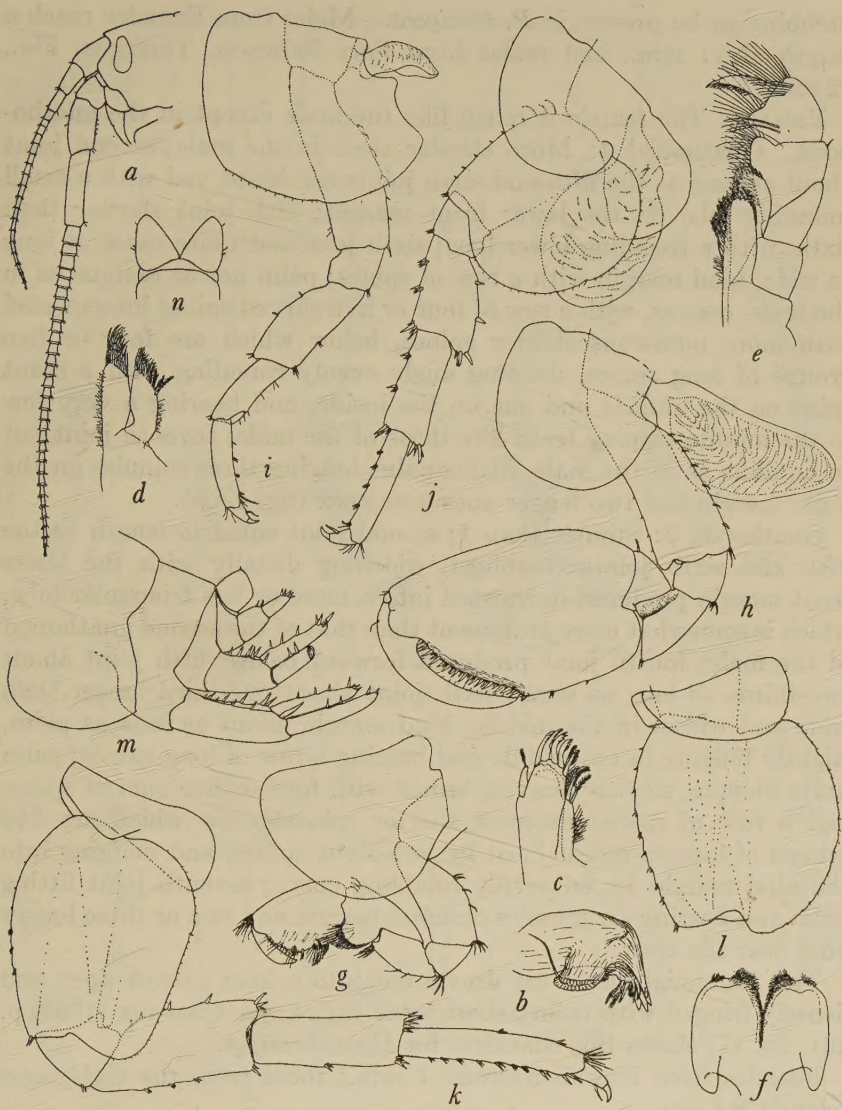

Figure 3.—*Parhyale hawaiensis* (Dana), male from Fort Jefferson, Tortugas, Fla.: *a*, head and antennae; *b*, mandible; *c*, maxilla 1; *d*, maxilla 2; *e*, right maxilliped; *f*, lower lip; *g*, gnathopod 1; *h*, gnathopod 2; *i*, peraeopod 2; *j*, peraeopod 3; *k*, peraeopod 4; *l*, peraeopod 5; *m*, rear end of animal; *n*, telson.

Stebbing to be present in *P. fascigera*. Males from Ecuador reach a length of 11 mm., and males from Fort Jefferson, Tortugas, Fla., 12 mm.

FEMALE: The female is much like the male except in the gnathopods. Gnathopod 1: More slender than in the male; second joint about as long as the fifth and sixth joints combined and with a small rounding lobe on the lower front margin; fifth joint shorter than sixth, with a rounding lower lobe; sixth joint not quite twice as long as wide, hind margin with a row of spines; palm not as oblique as in the male, convex, with a row of four or five curved spines interspersed with more numerous shorter spines, below which are four or five groups of long spines, defining angle evenly rounding with a stout spine on the outside and one on the inside, and bearing a very few of the minute rasping teeth like those of the male; seventh joint not so aquiline as in the male, fitting palm, bearing three spinules on the inner margin and two longer ones near apex (fig. 4,*o*,*p*).

Gnathopod 2: Stouter than 1; second joint equal in length to the fifth and sixth joints combined, widening distally with the lower front margin produced downward into a more or less triangular lobe, which is somewhat more prominent than that of the second gnathopod of the male; fourth joint produced forward below; fifth joint about two-thirds as long as sixth; sixth joint about one-third longer than wide and widest in the middle, hind margin about as long as palm, slightly bulging in the middle and bearing a row of long spines; palm quite oblique, slightly convex, armed with four or five curved spines and a row of more numerous shorter spines below which are five groups of long spines, defined by two stout spines, and merging into the hind margin by an evenly rounding curve; seventh joint fitting palm and bearing six spinules on inner margin and two or three longer ones near the apex.

The marsupial plates are drawn out into a long narrow apex and densely fringed with rather short setae (fig. 4,*r*). Cheveux (1901, p. 401, fig. 17) shows this character for *Hyale brevipes*.

Females from Hawaii measure 7 mm.; those from the Galápagos Islands, 8.5 mm.

As all of Dana's types have been destroyed, a neotype is here being designated.

NEOTYPE: A male, USNM 96984, from the Waikiki Marine Laboratory, Honolulu, Hawaii, taken by G. S. Mansfield on Apr. 24, 1942.

There has been considerable confusion as to the status of these two species of *Parhyale*. Dr. K. Stephensen (1948, p. 6) appears to have been the first to have noted the characters which distinguish

Figure 4.—*Parhyale hawaiensis* (Dana) from Johnston Island, Oceanica. Male, *a–n: a*, front end of animal; *b*, gnathopod 1; *c*, gnathopod 2; *d*, peraeopod 2; *e*, seventh joint of peraeopod 2; *f*, peraeopod 3; *g*, peraeopod 4; *h*, peraeopod 5; *i*, rear margin of second joint of peraeopod 5; *j*, end of sixth joint and seventh joint of peraeopod 5; *k*, rear end of animal; *l*, *m*, second and third metasome segments; *n*, telson. Female, *o–r: o*, gnathopod 1; *p*, end of gnathopod 1 enlarged; *q*, gnathopod 2; *r*, gnathopod 2 showing marsupial plate.

them. He, however, did not know that *Hyale inyacka* Barnard was a synonym of *Parhyale hawaiensis* (Dana), as he had never seen the latter species.

The literature has been examined and in many cases it has been impossible to determine which of these two species is being dealt with, as the distinguishing characters have not been mentioned or figured. The following identifications should have been *P. fascigera: Hyale brevipes*, Shoemaker (1933, p. 18, figs. 10–11); *Hyale hawaiensis*, Shoemaker (1942, p. 18).

The following identifications should have been *P. hawaiensis: Hyale aquilina*, Della Valle (1893, p. 523, pl. 16, figs. 43–47); *Hyale brevipes*, Chevreux (1901, p. 400, figs. 15–18); *Hyale nilssoni*, Walker (1905, p. 925, figs. 140–1); *Hyale prevostii*, Kunkel (1910, p. 66, fig. 25); *Hyale pontica*, Kunkel (1910, p. 69, fig. 26); *Allorchestes aquilina*, Chevreux (1911, p. 240, pl. 16, figs. 20–25); *Hyale prevostii*, Shoemaker (1920, p. 378); *Hyale brevipes*, Chilton (1921, p. 545, fig. 9♀); *Hyale inyacka*, Chevreux (1925, p. 370, fig. 17); *Hyale inyacka*, Stephensen (1933, p. 441, figs. 3, 4); *Parhyale fasciger*, Fage and Monod (1936, p. 105); *Parhyale inyacka*, Barnard (1940, p. 472); *Parhyale inyacka*, Stephensen (1948, p. 6); *Hyale hawaiensis*, Ruffo (1950, p. 57).

In the collection of the U. S. National Museum there are specimens of *Parhyale hawaiensis* from: Atlantic Ocean: Curaçao; Bonaire; Venezuela; Brazil; Dominica; St. Croix; Puerto Rico; Haiti; Colombia; Texas; Florida; North Carolina; Bermuda; and Belgian Congo. Pacific Ocean: Lower California; Costa Rica; Panamá; Ecuador; Hawaii; Galápagos Island; Johnston Island, Oceanica; New South Wales; and India.

Remarks: *Amphithoe aquilina* Costa (1857, p. 202, pl. 2, fig. 7) was described from the Mediterranean, and transferred by Stebbing (1906, p. 565) to *Hyale*. Chevreux and Fage (1925, p. 289, figs. 300, 301) figured it and placed it in *Allorchestes* because of the lobe of the fifth joint of the second gnathopod of the male. Their figures are strongly suggestive of *Parhyale:* The gnathopods and first uropod are much like those of *P. hawaiensis*, but the sixth joint of the fourth and fifth peraeopods does not bear spines on hind margin, which would indicate *P. fascigera*, and the fifth joint of the second gnathopod of the male (fig. 301 gn 2 ♂) bears a narrow lower lobe, but their specimen may not have been fully mature. The third uropod does not show a second ramus, but it could easily have been overlooked.

Hyale gracilis Iwasa (1939, p. 282, text-fig. 19, pl. 19) is strongly suggestive of *Parhyale hawaiensis*. James D. Dana (1853 and 1855) described and figured *Allorchestes gracilis* from Tongatabu, and Stebbing (1906, p. 572) transferred it to *Hyale*. Iwasa's name is therefore preoccupied, and I suggest the name *Hyale iwasai* for it.

Hyale stolzmanni described by A. Wrzesniowski (1879, p. 201) from the coast of Perú is probably a synonym of *Parhyale hawaiensis*, which species has been taken on the coast of Ecuador. He does not describe any of the essential characters and no figures are given, but his description, as far as it goes, applies to *Parhyale hawaiensis*.

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